

# **Battery Energy Storage Systems: Overview**

**Planning and Development Subcommittee  
Whatcom County Council  
June 7, 2022**

# Executive Summary

- A battery energy storage system can help balance the load on the power grid and deliver electricity to customers when it is most needed
- A battery energy storage system typically includes the following components:
  - Individual battery cells (often the size of an iPad), put into battery modules and stacked on racks and placed in containers
  - The containers are paired with inverters to convert DC-AC electricity
  - The system includes HVAC to maintain temperature control
  - Can be paired with a renewable energy asset (solar/wind) or standalone
- Most battery energy storage facilities, including NextEra Energy Resources facilities, employ lithium-ion batteries
- Like cell phone, laptop and electric vehicle batteries, most of the batteries used in utility energy storage applications will degrade over time and eventually reach an “end of life” (typically 10 to 20+ years)
- NextEra Energy Resources has not had a fire at any of its energy storage facilities and we take precautions, both in designing our systems and operating them, to reduce fire risk.

# Agenda

- **Climate Action Plan**
- **About NextEra**
- **Battery Energy Storage Systems (BESS) Benefits**
- **BESS Components with Whatcom County Code**
- **Community Concerns**
  - **Fire Safety and Fire Response**
  - **Hazardous Waste**
  - **Site Safety**
  - **Permissible Sound Level**
- **Next Steps**
- **Questions & Answers**



# BESS implements the Whatcom County Climate Action Plan

## Climate Action Plan and BESS

- BESS implements the Whatcom County Climate Action Plan by providing grid resiliency and modernization to more effectively balance electricity supply and demand in real time as conditions demand which can reduce GHG emissions in Whatcom County. As referenced in the Climate Action Plan

Page 29: “Strategy 4: Focus on Buildings as Grid Assets to Maximize the Grid’s Reliability and Resilience. Accelerate the Use of Clean Distributed Energy Resources (DERs) and Microgrids to add Renewables, Reduce Peak Electricity Demand, and Provide Electricity to the Most Important End Uses.”

Page 27: “Renewable generation with battery storage can overcome daily issues in electricity peak demand.”

**BESS PROVIDES POWER WHEN IT’S NEEDED**

# Battery Energy Storage Systems are important for grid stability and for capacity support

## NextEra Energy Resources and BESS

- NextEra Energy Resources is the world's largest generator of renewable energy from the wind and the sun, and a leader in BESS that has earned a reputation for excellence
- NextEra Energy Resources has hundreds of megawatts (MW) of operational energy storage projects across North America, with hundreds of additional MW currently under construction
  - These facilities are being used for frequency regulation and capacity support. i.e. batteries are taking the place of fossil fuel based peaking plants, as they are quiet, safe and do not emit various air emissions



# There are multiple benefits to having a Battery Energy Storage System in your community

## BESS Benefits

- **New technology allows stand-alone BESS to provide an independent service to utilities seeking to balance load on the grid:**
  - Allows energy to be delivered instantly, in the required amount, and provides for a seamless switch between power sources
  - Stand-Alone BESS facilities can serve as a back-up reserve of energy in the event of power interruptions elsewhere in the grid
    - Voltage support; frequency support; unexpected outage support (rolling black-outs)
- **Other benefits of energy storage include:**
  - No greenhouse gases or other air pollutants, no use of water to generate electricity, and a renewable supply of energy
- **Energy Storage is safe, and reliable**
  - NEER exclusively procures battery modules and inverters that have been UL tested and certified
    - Underwriters Laboratories is a highly credible testing organization that now goes by its initials, UL

**Complete battery storage systems includes the battery, HVAC, power controls, battery management systems, inverters and transformers**

## **Battery Energy Storage System (BESS) Description**



**Each BESS facility is designed specifically for its site layout. No two sites are the same. There will also be variation among developers/applicants of BESS facilities. The following provides some information typical to the industry...**

## Battery Energy Storage Containers





## Battery Energy Storage Containers cont.



# BESS sites are relatively small, and generally directly adjacent or very close to utility substation

- They have a relatively small footprint, typically between 1 and 5 acres
- They are not complex; they typically include just the BESS and associated inverters
- They are typically adjacent to or near existing transmission lines and adjacent to and/or integrated with utility substation sites



## They have minimal visual impact.

- The BESS enclosures are of a low height (usually between 12 and 15 feet)
- They are typically painted a muted color
- They require minimal lightning which per the zoning requirements will be directed away from adjacent land uses



# Fires involving Battery Energy Storage Systems are rare

## BESS and Fire Safety

- Energy storage systems typically consist of racks of batteries, not unlike the kind used in common electronic devices like laptops and smart phones
- Batteries contain organic material that may be flammable, but only in rare and extreme conditions
- Each battery is continuously monitored by an on-site system to automatically detect abnormal conditions and stop operations, if needed
- An off-site, 24-hour control room with trained technicians also constantly monitors each site and can remotely shut down the facility, if needed

# Our energy storage projects are engineered to meet the highest standards of safety and fire protection

## BESS and fire safety cont.

- All of the battery module designs included in our facilities undergo rigorous industry testing and certification related to fire safety, in order to minimize the risk that a failure of any single battery cell or module spreads to adjacent batteries or other equipment
- Each storage facility is equipped with its own air conditioning or cooling system to ensure it operates within the ideal temperature range
- Our company will coordinate with first responders and fire officials to safely extinguish any fire and dispose of any damaged materials in compliance with local, state and federal regulations

**There are no significant health or environmental concerns related to battery fires including the toxicity of emissions**

## BESS and Hazardous Waste

- **Used lithium-ion batteries are NOT considered hazardous waste by the EPA; at present there are optional EPA guidelines (EPA's Universal Waste Regulations) which address the responsible disposal and recycling of these batteries**
  - NextEra Energy Resources follows the EPA's Universal Waste Regulations<sup>75</sup> at our battery energy storage facilities, and will not dispose of battery cells in a municipal landfill.



**While BESS facilities do not always have on-site security guards, each site is fully secure with the appropriate safety systems**

## BESS and Site Safety

- In addition to the extensive fire safety standards we adhere to, NextEra Energy secures each of its sites with the following protections:
  - Badge-only entry
  - Safety fencing around the site boundary
  - On-site system monitors
  - 24-hour site control room



# Battery storage facilities are not a source of noise nuisance

## BESS and Permissible Sound Level

- During the construction period, sound level at the project site would be typical of construction sites. The typical types of equipment used during the construction process are small tractors, front-end loaders, trenching machines, excavators and vibratory pile drivers
- Once operational, the only sources of sound at the project would be a low "hum" typical of power equipment. The sound can be described at the level of "casual conversation"
- These types of equipment are typically sited as far away from any sensitive areas (including residences) as possible
- They are also orientated on the site to minimize the potential for impacts
- BESS facilities are also designed to comply with all state (Chapter 173-60 WAC) and/or local sound level regulations
- For these reasons, sound mitigation is typically not necessary



**After adoption of BESS into the zoning code (WCC Title 20, Zoning), land use, construction and building permits will be obtained for each individual project and will meet federal, state, and local laws**

**Examples...**

- **Land Use Permits – either CUP or administrative review (compliance with all applicable WCC Title 20 Sections)**
- **Building Permits**
- **NPDES 1200-C (construction stormwater)**



## Questions or Comments?

- **Please contact with any additional questions:**
  - [Ufuoma.ojumah@nexteraenergy.com](mailto:Ufuoma.ojumah@nexteraenergy.com)
  - <https://www.nexteraenergy.com/company/work/battery-storage.html>

### Our Values

#### We Are Committed to Excellence

By establishing high standards of quality, driving continuous improvement, making fact-based decisions, working safely and holding ourselves accountable, we cultivate the expertise and passion to deliver the best for our shareholders, customers, employees and stakeholders.

#### We Do the Right Thing

By acting with integrity and humility in everything we do, living up to our commitments, and being forthright and honest in our communications, we create an environment of openness and trust.

#### We Treat People With Respect

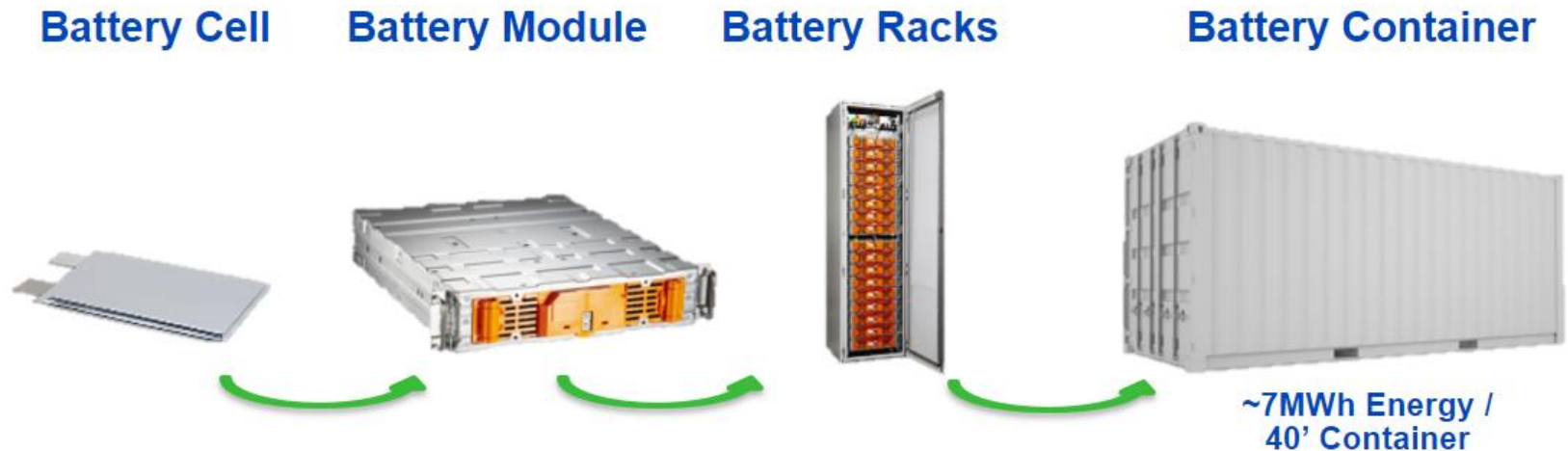
By leading respectfully, promoting teamwork, building a diverse and inclusive team, and investing in development, we strengthen and engage our greatest asset – our people.

# Appendix



**Battery cells are connected to form battery modules; multiple battery modules are stacked into battery racks. Several racks are built up within containers or buildings**

## BESS Description



- **The battery system is comprised of lithium-ion battery cells built into modules. The modules will be in racks within an enclosure, which will be mounted on skids or using a concrete foundation/ pier design**
- **Each rack has its own battery management system to communicate and actively manage performance and safety metrics**
- **The racks will be connected to disconnect switches that ultimately connect to the inverter. The battery racks are typically housed in ISO or customized containers, mounted on a concrete pad**

**HVAC and fire suppression systems are integrated into the container. PCS (Power Control System) and pad-mount transformers are outside of the system connected by cabling**

## BESS Components



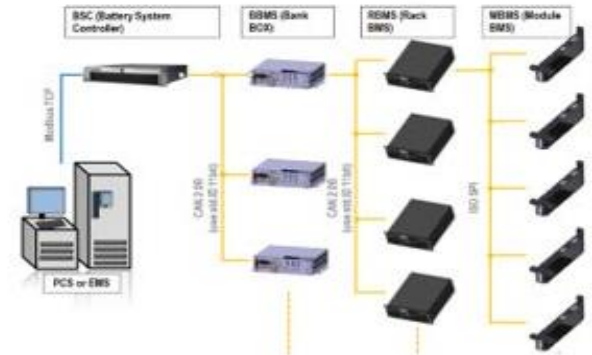
### HVAC

Programmed to match charge & discharge heat load



### Power Controls

Managed by inverters

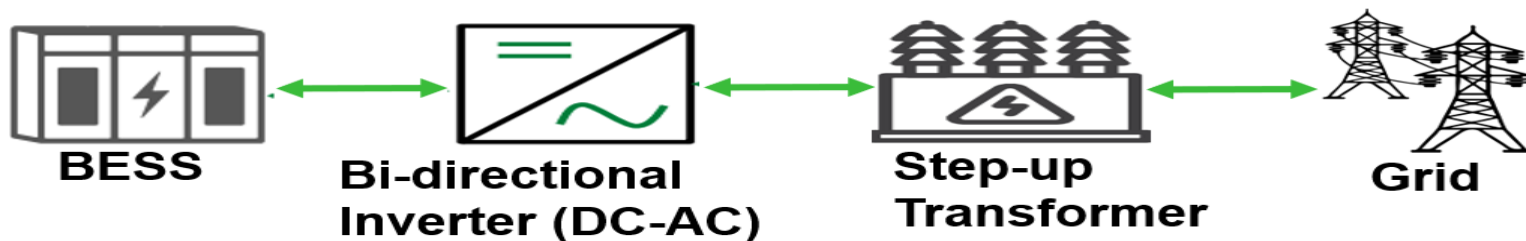


### Battery Management System

Hierarchical structure, from module level to site level

- The PCS is typically integrated on a skid with or without the medium-voltage transformer (for AC coupled systems). Thermal management system of the racks will be supported with HVAC units installed on the enclosures

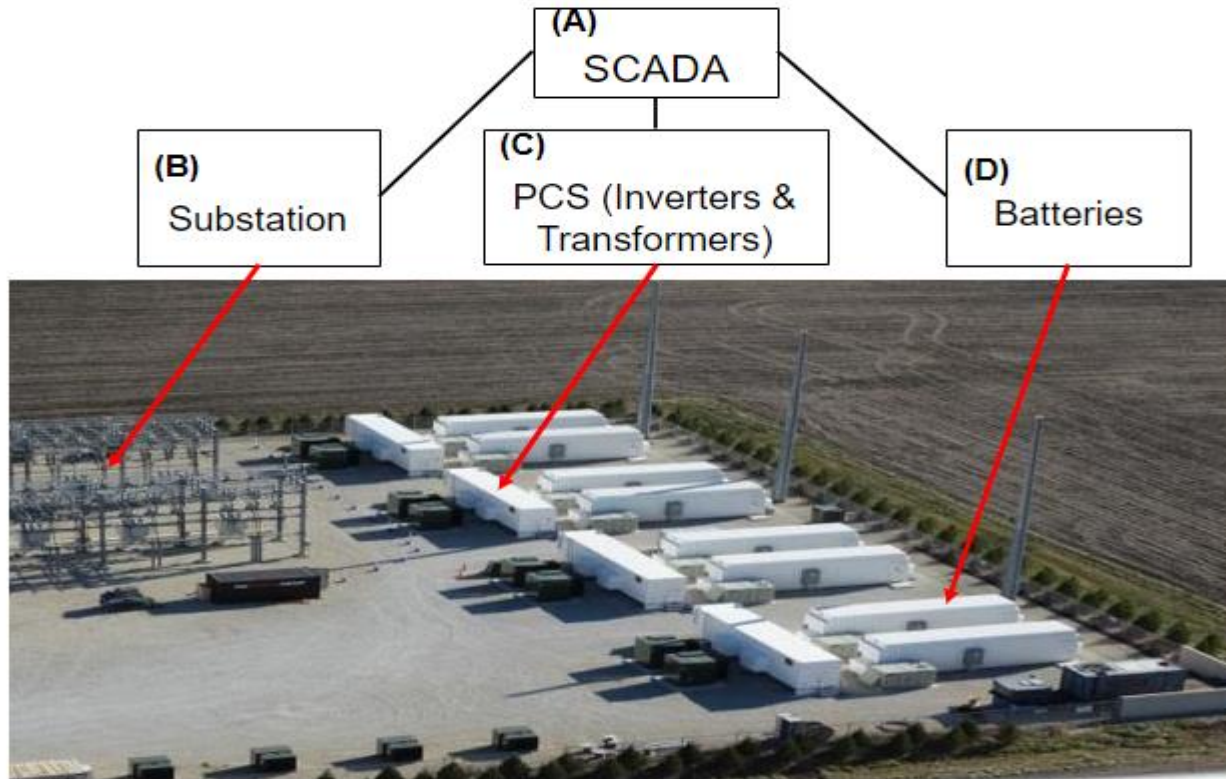
## BESS Components (cont.)



- **Inverters convert direct current (DC) electricity to alternating current (AC) electricity. This energy goes into an array of batteries that is typically housed within a battery container or a building structure. BESS uses a bidirectional inverter that allows for power to flow both ways to charge and discharge the battery**
- **NextEra carefully selects the inverter manufacturer and specific model/features based on the unique requirements of each project and optimized for the most efficient design and reliable long-term operation of the site**
- **Balance of system equipment/materials will include the DC and AC collection facilities, grid interconnection equipment, communications and relay equipment, and main transformers**
- **Transformers steps up the AC electricity to a higher voltage to match the provided interconnection voltage at the substation**

# Main Components of a Battery Site include SCADA, Substation, Inverters, Transformers, & Batteries

## What does a BESS Site look like?

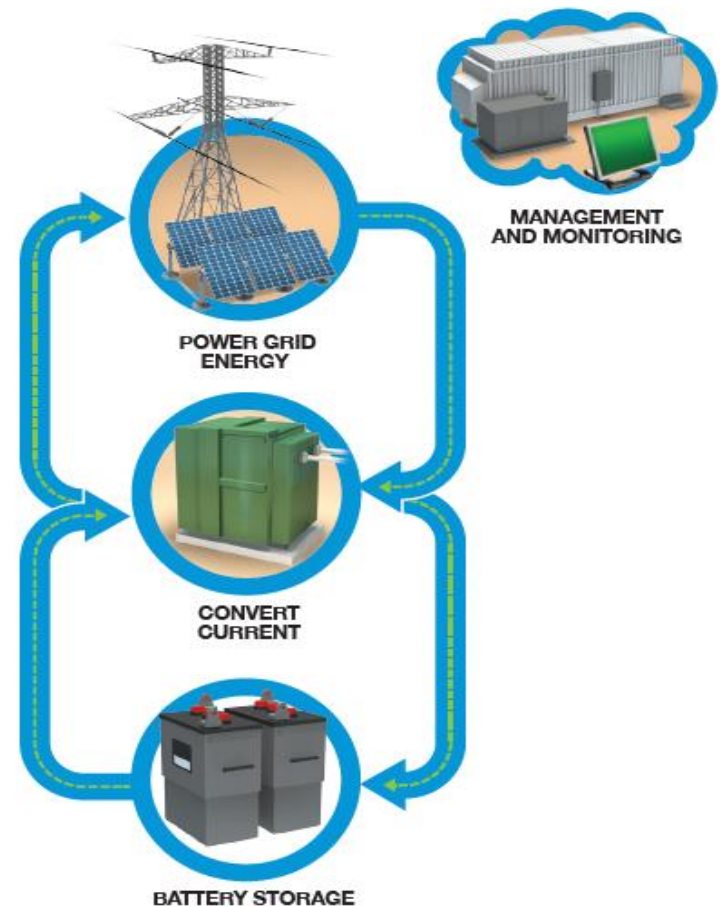


- The BESS will be connected to a SCADA communications facility linked to NextEra's central monitoring system. A battery management system monitors the voltage, temperature and current for safe, reliable transfer of energy

# Supervisory Control and Data Acquisition (SCADA): computer-based system gathers and analyses real-time data to monitor and control the BESS

## How Battery Energy Storage Systems Work

- A battery management system monitors the individual cells and controls the voltage, temperature and current for safe, reliable transfer of energy.
- A computerized monitoring system provides up-to-date weather forecasts, power prices, historical electrical use, the amount of charge remaining in the batteries and when to use the energy storage system





# The BESS will also be remotely monitored 24/7 by NextEra's proprietary asset management system

## How Battery Energy Storage Systems Work (cont.)

- **Monitoring/SCADA:** All monitoring and performance information is fed back to our Renewable Operations Controls Center (ROCC) in Juno Beach 24 hours a day, 7 days a week. From this center, any resources that need to be dispatched to the site can be handled real time for scheduled and unscheduled maintenance.
- The BESS automatically shuts off if the batteries are operating outside of the predefined parameters.
- When the energy is needed on the power system, the inverters are then used again, but this time to convert the DC from the batteries into AC. Once the power has been transformed, it is stepped up in voltage and subsequently sent to an on-site substation or directly to a distribution or transmission line
- The electricity is then distributed to homes, schools, businesses and other consumers

# Projects will be designed, and the site maintained to the latest applicable standards

## BESS and fire safety cont.

- Battery Modules
  - UL164: Lithium Batteries
  - UL1973: Standard for Batteries for Use in Light Electrical Rail and Stationary Applications
  - UL9540A: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery storage Systems
- Inverters
  - UL 1741: Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
- Integrated Design
  - NEC 2017: National Electric Code
  - NFPA 855: National Fire Protection Association



# Early and continued engagement with local fire agencies is critical in safely developing and maintaining BESS projects

## BESS and Fire Response

- NextEra Energy Resources provides orientation to first responders before we place our battery facilities in service, in addition to offering on-going training
- **ACCESS:** With only a few exceptions, our systems installed 2015 or later employ smaller battery containers that are not designed for people to enter. By performing our maintenance externally, we eliminate the need to physically enter the container and significantly reduce the risk to technicians and first responders
- **MONITORING:** We employ auxiliary power to maintain our monitoring systems, ensuring we will continue to have visibility of conditions inside the container during any abnormal event
- **INSULATION:** Our batteries include enhanced insulation within the battery modules, which provide additional barriers to reduce the likelihood of the failure of a single battery cell to propagate to adjacent cells within the system

## BESS and Fire Response cont.

- **SUPPRESSION:** Our current battery system design (for large-scale systems) employs small fire suppression strips within the battery modules. These strips detect the build-up of excess heat and release fire suppression chemicals at the module level
- **VENTILATION:** Our current battery system design includes active ventilation to suck potentially explosive gasses out of the battery container before they can build up to a high level, removing the risk of oxygen getting introduced to the environment and contributing to an explosion
- **TESTING:** Our current and upcoming battery systems complete two new testing standards that did not exist at the time of the McMicken incident (UL-9540A and NFPA-855)

## **BESS and Fire Response cont.**

- **We recommend first responders wait at least 72 hours from the time of an initial fire report at a battery facility before approaching that facility**
  - After 72 hours, any fuel that could be sustaining the fire would likely be exhausted, minimizing the risk to first responders
- **In addition, we post signage at our battery facilities describing the technology and providing warning instructions to first responders in the event of an incident**
- **In responding to a fire at a battery storage system, we recommend first responders only use water if it appears the fire is spreading beyond the battery container**

**BESS technology is every evolving and progressing.  
NextEra Energy is a part of that advancement**

## Battery Testing

**Our company operates a cutting-edge battery testing facility in Riviera Beach, FL. Here, we study battery performance to help optimize our maintenance and replacement schedules for our battery storage systems. While lithium-ion batteries are the most commercially viable technology today, we are also evaluating other battery chemistries and technologies to continue to advance this growing industry**

